



Davidson Canyon and Lower Cienega Creek Sample and Analysis Plan

Santa Cruz Watershed
Pima County, Arizona

December 2015

1.0 INTRODUCTION

Lower Davidson Canyon (Spring located at 31°59'00"/110°38'46" to Cienega Creek, excluding the ephemeral reach) and Cienega Creek (Gardener Canyon to Pantano Wash) are designated as Outstanding Arizona Waters (OAW) per *Arizona Administrative Code* (A.A.C.) Title 18, Chapter 11, Section 112(G). As such, both stream segments are given Tier 3 antidegradation protection per A.A.C. 18-11-107.01(C) which prohibits a new or expanded discharge directly to an OAW or a discharge that is tributary or upstream from degrading the water quality in a downstream OAW.

Although low or baseflow data have been collected from lower Davidson Canyon and Cienega Creek by the Arizona Department of Environmental Quality (ADEQ) and Pima County no stormwater data have been collected. In contrast, no baseflow data exists in the upper watershed due to its ephemeral nature; however Rosemont Copper began collecting stormwater samples from Barrel Canyon and upper Davidson Canyon in 2010 as part of their voluntary monitoring program. In order to determine current water quality conditions ADEQ will initiate a low flow and stormwater sampling program.

1.1 Purpose of Project

This Sample and Analysis (SAP) will provide a plan for the collection of water quality data that will determine baseline stormwater and low flow conditions and inform future water quality assessments. Based upon Rosemont's stormwater data, primary constituents of concern include arsenic, copper, lead and selenium however; additional parameters will be collected to meet 305(b) water quality assessment requirements. Low flow data from the OAWs have not resulted in any water quality exceedances being reported in recent 305(b) water quality assessments.

1.2 SAP Objectives

The primary objective of the SAP is to provide for the collection of a representative body of water quality and stream flow data to characterize current water quality conditions within the Davidson Canyon and lower Cienega Creek watersheds prior to the construction of the Rosemont Copper mine. The data must be credible and scientifically defensible as described in the A.A.C., Title 18, Chapter 11, Article 6.

2.0 BACKGROUND

Davidson Canyon and Cienega Creek are located in Pima County, southeast of Tucson. Prolonged drought conditions, increased groundwater pumping and the proposed Rosemont Copper project all have the potential to impact surface water quality. Lower Davidson Canyon and lower Cienega Creek are OAWs and afforded a higher level of protection under A.A.C. 18-11-107.01(C). Although water quality data have been collected since the 1980s, it has been temporally and spatially limited. Therefore, a robust dataset is required to understand current conditions and establish a baseline against which future data can be compared to ensure that water quality is being protected.

Figure 1 shows the sample sites and Table 1 contains the length and designated uses for stream reaches that the sample sites are located within.

Table 1. Sample Site Reach Information and Designated Uses

| Reach | Length (mi.) | Designated Uses |
|---|--------------|-----------------------|
| Davidson Canyon (15050302-153A)- Headwaters to OAW | 13.6 | A&We, AgL, PBC |
| Davidson Canyon OAW (15050302-153B) - Spring located at 31°59'00"/110°38'46" to Cienega Creek, excluding the ephemeral reach | 0.4 | A&Ww, AgL, FC, FBC |
| Cienega Creek (15050302-006B)- Gardener Canyon to Pantano Wash | 28.8 | A&Ww, AgL, FC, FBC |

A&Ww- Aquatic and Wildlife, warmwater
A&We- Aquatic and Wildlife, ephemeral
AgL- Agricultural Livestock Watering

PBC- Partial Body Contact
FC- Fish Consumption
FBC- Full Body Contact

Sample Sites Davidson Canyon and Cienega Creek

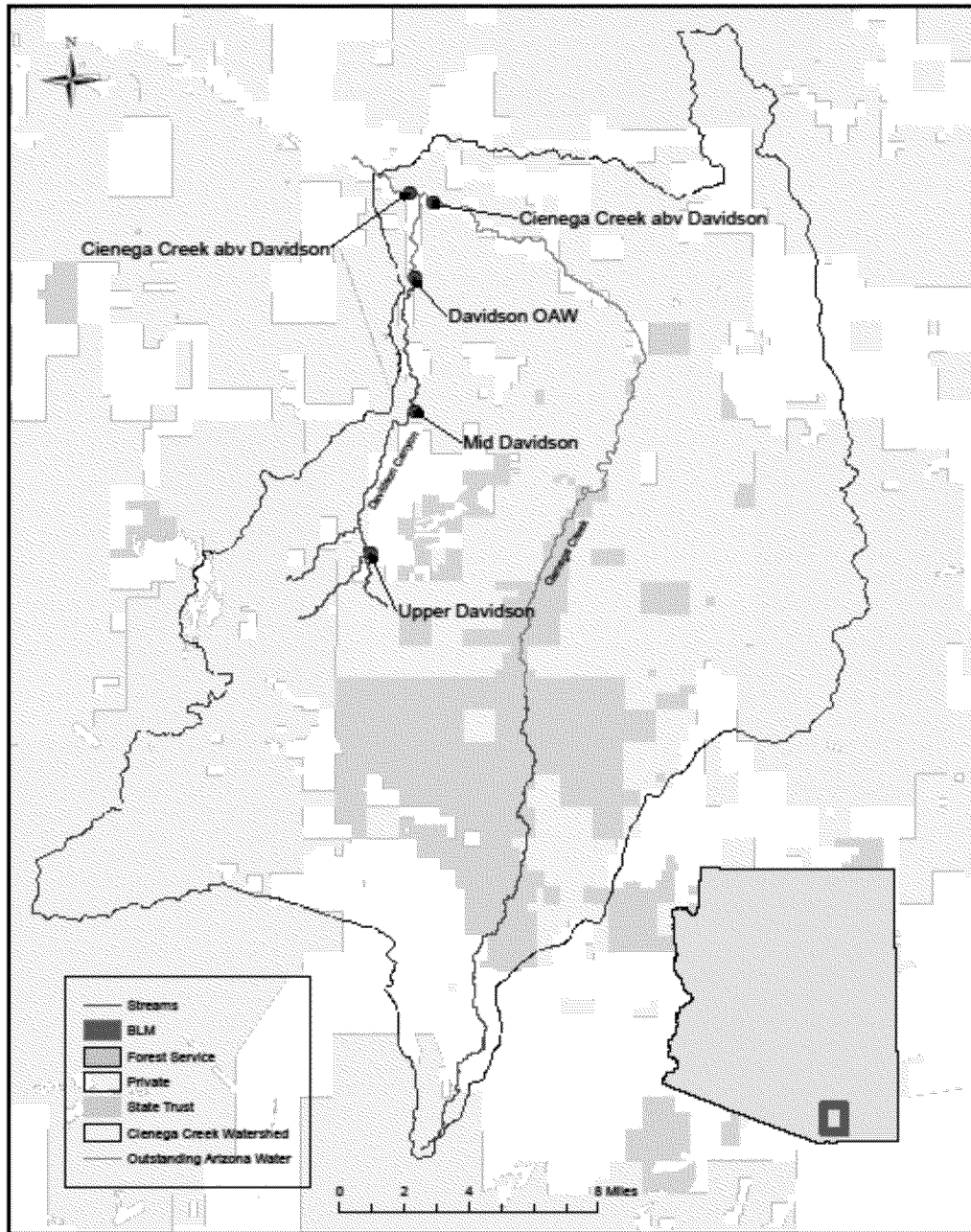


Figure 1. Sample Sites

3.0 DATA QUALITY OBJECTIVES

The Impaired Waters Identification Rule (IWIR) (A.A.C. R18-11-6) states that data collected must be credible and scientifically defensible. In order to meet those requirements, data quality objectives (DQOs) are set. The DQOs include precision, accuracy, representativeness, comparability, and completeness, commonly referred to as the PARCC criteria. The objective of the DQOs is to produce a data set with well-defined levels of quantitative and qualitative uncertainty by defining the minimum level of data quality that is acceptable.

3.1 Precision

Precision is enhanced through a consistent approach to all data generation activities, such as field measurements and calibrations, sample collection (grab and automatic sampler), custody protocols, sample handling and preservation, laboratory analysis, and all calculations and data handling. To optimize consistency, all activities required to generate data throughout the project are directed by Standard Operating Procedures (SOPs). Unless otherwise specified, the SOPs for this project will be those listed in the ADEQ Standard Operating Procedures for Surface Water Quality Sampling (ADEQ, 2012). SOPs help ensure all data generation activities are uniform and well documented. Any exceptions to the protocols established in the SOPs, should be noted at the time of the occurrence. The laboratory and specific analytical methods chosen for analysis of the samples throughout this project are to be of those certified by U.S. Environmental Protection Agency (EPA) and /or Arizona Department of Health Services (ADHS). This is required to ensure that data of known quality and consistency are produced in order to meet the needs of the project.

3.2 Accuracy

Accuracy is a measure of how closely the data produced represents the true value for a measurement. To assure accuracy throughout the project, laboratory and field measurements, with their associated analytical method(s), should be selected on the basis of accreditation to a known standard of performance. The use of current and best available technology is a primary consideration in the selection process. Adherence to established SOPs for all activities to assure uniform execution is also of key importance.

3.3 Representativeness

The objective is to produce data that truly reflects the character of the site or condition being examined by the project. Consideration is given in the SAP to account for sample site selection, collection techniques, type of samples, and analytes chosen. Care is taken that samples reflect seasonal influences and that natural backgrounds are accounted for. Choices are guided by the desire to truly reflect the problem and character of the water body.

3.4 Comparability

The purpose is the production of reproducible data throughout the project, for which it is valid; to compare or contrast project sample results, spatially and temporally. This goal is pursued through use of uniform collection, handling, analytical, and measurement

methods as directed by the appropriate SOPs. Production of reproducible data is aided by efforts to assure that conditions of data generation throughout the project do not differ in any way (e.g. collection, analytically, spatially, or temporally). If all data generation activities are uniform and documented, with any exceptions noted, then data sets can be compared or contrasted with defined confidence.

3.5 Completeness

The objective is that the number of samples to be taken is sufficient to characterize the nature of the problem and site, with consideration given to possible spatial and temporal impacts, natural backgrounds, and all foreseeable potential impacts affecting the presence of the targeted pollutants within the reach. In addition to satisfying the IWIR requirements, the samples collected must meet the needs of the evaluation and allow for the needs of models chosen for the project. Sampling throughout all phases of mine remediation is necessary to identify and quantify improvements. Additional samples are planned to be collected to satisfy “core parameter” data requirements for water quality assessment purposes.

3.6 Data Handling and Analysis

In order to fulfill the objectives set forth in the DQOs, data must be reviewed upon returning from the field and receipt from the laboratory. Data will be handled using the following guidelines:

1. Evaluate data against chain of custody (COC) and past or expected results;
2. Reconcile problems with results;
3. Enter data and have data Quality Assurance (QA)/Quality Control (QC) checked within one month of receipt; and
4. Adjust SAP as data warrants.

Statistical analysis methods, as outlined in Statistical Methods in Water Resources (Helsel and Hirsh, 2002), will be used. Comparison of results to water quality standards will determine the degree of attainment.

The SAP, using the DQOs as guidance, is intended to collect a body of data that is both comprehensive and scientifically sound. The body of data will be considered sufficient for 305(b) Assessment purposes once seasonality and spatial variations in water quality have been addressed. A full evaluation of the data collected will occur after the 2015 monsoon season and again following baseflow sampling anticipated to be completed in early 2016.

4.0 SAMPLING PLAN

Three Davidson Canyon and two Cienega Creek sites will be sampled (Table 2 and Figure 1). Historic water quality data are available from sites 109222, 100263 and 100598. The mid and upper Davidson Canyon sites are newly established sites. These sites will serve as the baseline for comparison to data collected under this SAP in addition to data collected under Rosemont’s Phase 1 voluntary and 401 Surface Water Mitigation monitoring plans. Given the flashy nature of flows in the watershed and

distance from Phoenix, ADEQ will install an automated sampler in the OAW and mid-reach Davidson Canyon sites. ADEQ will install a passive stormwater sampler at the upper Davidson Canyon site. Grab samples will be the primary collection method at the Cienega Creek sites but will also be collected at the Davidson Canyon sites as conditions allow.

Table 2. Sample Site Descriptions and Unique Identifiers

| Description (Reach) | Site ID | ADEQ # |
|---|----------------|---------------|
| Davidson Canyon at OAW Spring Source 34° 59' 01.5", 110° 38' 46.7" | SCDVC002.50* | 109222 |
| Cienega Creek at Marsh Station Road 32° 01' 09", 110° 38' 44" | SCCIE002.89 | 100263 |
| Cienega Creek above Davidson Canyon 32° 01' 9.2", 110° 38' 27.8" | SCCIE003.26 | 100598 |
| Mid Davidson Canyon 31° 55' 11.2", 110° 38' 59.6" | TBD* | TBD |
| Upper Davidson Canyon 31° 51' 23", 110° 40' 19.4" | TBD | TBD |

* Automated sampling sites

4.1 Sample Sites

As mentioned above five sites will be sampled to determine current water quality conditions in Davidson Canyon and lower Cienega Creek. The rationale for sampling each site follows.

4.1.1 Davidson Canyon at OAW Spring Source (SCDVC002.50)

The site is located within the upper Davidson Canyon OAW reach below the southern spring located within the Cienega Creek Natural Preserve (Preserve). Data from this site will establish baseline water quality entering the Preserve from upper Davidson Canyon under high flows and confirm water quality during low flow conditions based on two ADEQ sampling events from 2012.

Stormwater data collected from within the OAW is key to establishing the baseline against which future data, post mine construction, will be compared. Therefore, ADEQ will install automated sampling equipment to capture samples under variable flow conditions. In addition to an autosampler and level logger, this site will also be equipped with a data recorder, which will transmit stream stage and weather data to an ADEQ webserver every 15 minutes. The telemetry data is then posted on ADEQ's website-
<http://www.azdeq.gov/envIRON/water/monitors/>

4.1.2 Cienega Creek at Marsh Station Road (SCCIE002.89)

This site will measure the combined water quality from Davidson Canyon and upper Cienega Creek. ADEQ has a long period of data collection, extending from

1987 to 2013; however the majority of this data is low flow data. This site is located within the OAW reach of Cienega Creek and the Preserve.

4.1.3 Cienega Creek above Davidson Canyon (SCCIE003.26)

Data from this site will serve as baseline data for upper Cienega Creek prior to its confluence with Davidson Canyon. ADEQ has only sampled this site once under low flow conditions in 1998. This site is located within the OAW reach of Cienega Creek and the Preserve.

4.1.4 Mid Davidson Canyon (TBD)

The sample site is located downstream of South Sonoita Highway on State Trust Land. The site is approximately 2.2 miles downstream of Rosemont Copper's DC-3 sample site and 5.2 miles above the Davidson Canyon OAW. Data from this site will fill a data gap that currently exists between DC-3 and the Davidson Canyon OAW.

ADEQ will install automated sampling equipment (autosampler and level logger) to collect samples under variable flow conditions and collect stream level information.

4.1.5 Upper Davidson Canyon (TBD)

Although Rosemont Copper has a proposed sample site located on Davidson Canyon above Barrel Canyon no water quality data has been collected due to their inability to obtain access. ADEQ will establish a sample site below the confluence of Davidson Canyon and East Fork Davidson Canyon. This site will be used to determine background water quality in relatively undeveloped areas of the watershed.

Since the site is located in the headwaters area of the watershed, any flows will likely be short in duration. Therefore, ADEQ will use passive stormwater samplers to collect water quality samples. A tipping bucket rain gauge will also be installed near the site to collection precipitation data form the upper watershed. The site is located on State Trust Land.

4.2 Sampling Frequency

Sampling will primarily target stormwater runoff since this is the critical condition when water quality exceedances have previously been observed. Unattended sampling equipment (autosamplers, level loggers and stormwater samplers) will be installed in order to sample events when they occur. The equipment will be serviced as soon as accessible after storm events and served once a month depending on precipitation patterns. Manual grab samples, field water quality parameters, and discharge will be collected during field visits as conditions permit. Stormwater sampling efforts will primarily focus on the two rainy seasons (January-March and July-September) with a minimum of two sampling events targeted per season. Low flow sampling will occur in the cooler months when baseflow is expected to occur, with a minimum of two sampling events.

4.3 Target Analytes and Analytical Methods

The suite of analytes for this project will include ADEQ's Ambient Monitoring program's five bottle suite, see Appendix A. Table 3 lists the analytes, analytical methods and method reporting limits (MRLs) for the identified constituents of concern based upon historic water quality data. As mentioned in Section 1.1 and above, additional parameters will be included in the sample suite to fulfill 305(b) Assessment needs.

Table 3. Analytes of Concern, Analytical Methods and Reporting Limits

| Analyte | Method | Reporting Limit |
|------------------------------|-----------|-----------------|
| Copper (total and dissolved) | EPA 200.7 | 10 µg/L |
| Lead (total) | EPA 200.8 | 1 µg/L |
| Arsenic (total) | EPA 200.7 | 3 µg/L |
| Selenium (total) | EPA 200.7 | 1 mg/L |

In order to develop a more robust dataset, analytical results that fall between the MRL and method detection limit will be reported as an estimated value by the laboratory rather than as a non-detect.

5.0 FIELD METHODS

Samples and field data will be collected using ADEQ-collection techniques (detailed in ADEQ, 2012) with as few deviations from protocol as possible. Samples will be analyzed by a state license laboratory using ADHS or EPA approved analytical methods with as few deviations from protocol as possible. Deviations will be noted in the project field notebook.

5.1 Health and Safety

Personal safety always has priority over samples and sample collection. Refer to the Health and Safety Plan in Appendix B. An emergency contact sheet will be completed prior to leaving Phoenix for field activities. Copies are distributed to the Watershed Protection Unit Supervisor or Surface Water Section Manager and the emergency contacts will be listed for each team member. Refer to the sample form in Appendix C.

5.2 Field Activity Documentation

All sites will be photographed during every visit. Notes to be made during each visit include specific field parameter measurements and general observations related to: accessibility, hydrologic features (stream bed material, flow conditions, obstructions, etc.), vegetation (presence/absence compared to upstream/downstream), water clarity, odor, color, bottom and bank material, and overall suitability as a sampling site. Changes will be noted at each subsequent visit in either a field notebook or on the field data sheet (Appendix D).

5.3 Sample Collection

Most water samples will be collected by autosamplers and, when available, manual grab samples following the ADEQ Standard Operating Procedures for Surface Water

Quality Sampling (ADEQ, 2012). All samples will be placed in a cooler with ice immediately after collection and kept on ice and/or refrigerated during transport until delivery to the laboratory. Samples collected by the autosamplers will be chilled as soon as they are retrieved. A Chain of Custody will be maintained on all samples at all times until delivered to the analytical laboratory.

5.4 Field Measurements and Equipment

Site conditions will be described during each site visit. These descriptions will be recorded in a bound field notebook and/or on the Field Data Sheet (Appendix D) and will include the following information:

- Type of work being completed (i.e. reason for visit)
- Location of work
- Weather conditions
- Estimated recent precipitation amounts
- Temperature
- Ongoing activities that may influence or disrupt sampling efforts
- Accessibility to the sampling locations (e.g. rough terrain, fallen trees, flooding, etc.)
- Maintenance completed on autosamplers
- Condition of autosamplers

General field-measured water quality data will be obtained with a HydroLab Mini Sonde and Surveyor or comparable instrument. These measurements will include:

- Water temperature (°C)
- Dissolved oxygen (mg/L and % saturation)
- Specific conductance (µS/cm)
- pH (SU)
- ORP (mV)
- Total Dissolved Solids (TDS; mg/L)

Other general field-measurements include:

- Air temperature (°C)
- Turbidity
- Discharge (cfs)
- Barometric pressure (mm Hg)
- Depth of water at level logger transducer (feet), if one is installed at the site

5.5 Sample Bottle Labels

Each sample bottle will be labeled similar to the following example:

Site ID: SCXXX000.00

Date: MM/DD/YY

Time: HR:MM (24-hour clock)

Samplers Initials

Parameters and Analysis Requested:

Preservation (if necessary)

Sample bottles will be labeled with an indelible pen. Where necessary, the label will be protected from water and solvents with clear tape. Additional notes should be made regarding filtering, and special methods should also be listed on the bottle. If preservation acid is used, the appropriate sticker will also be added to the bottle and clear tape will be placed over the top of the sticker.

5.6 Sample Custody

Sample custody is a part of a quality field or laboratory operation. Custody of a sample is defined as:

- Having physical possession
- Being in view, after being in possession
- Having possession, then being stored in a secure area
- Being maintained in a secure area by the person who last had possession

These custody practices will be observed while ADEQ has possession of the samples. Prior to leaving for the field a tracking number will be obtained and noted in the project field book and the laboratory COC. Proper documentation of field samples includes entering information into the field book, field forms and the COC for each sample collected.

5.7 Instantaneous Discharge Measurements

The preferred method for measuring instantaneous stream discharge by flow meter, tape and top setting wading rod are described in the ADEQ Standard Operating Procedures (SOPs) for Surface Water Quality Sampling (ADEQ, 2012). An alternative method for measuring stream discharge is the “float” method, also described in the ADEQ SOPs. When water is flowing during a site visit, discharge measurements will be taken.

5.8 Automated Water Quality Sampling

One autosampler will be installed at the Davidson Canyon at OAW Spring (SCDVC002.50) and another at the mid Davidson Canyon (TBD) sample site. The methods for water quality monitoring by automated samplers and programmable field loggers (level loggers) are described in the ADEQ Standard Operating Procedures for Surface Water Quality Sampling (ADEQ, 2012).

5.9 Stream Stage Logger

A stream stage logger will be installed at the two automated sample sites, Davidson Canyon at OAW Spring (SCDVC002.50) and mid-Davidson Canyon (TBD). The loggers provide a record of stream stage where no USGS stream gaging station exists. The level logger data, in conjunction with several manually obtained stream discharge measurements, obtained at different stages, provide the information necessary to estimate a stage-discharge relationship. The logger data, used in conjunction with the Barrel Canyon USGS gauge and DC-3 data, will be used to determine the duration, frequency and distance the flows from Barrel Canyon persist in Davidson Canyon.

5.9 Stormwater Samplers

Passive stormwater samplers commonly referred to as first-flush samplers, will be installed at the upper Davidson Canyon (TBD) site. The advantage of using first-flush samplers over auto-samplers for collecting the first moments of the storm have largely to do with cost, portability, and relative ease of deployment.

The first-flush sampler consists of a one-liter Nalgene bottle with a specifically-designed cap. The cap is designed so that sediment-laden water falling on top of the cap is diverted radially around an ellipsoid-shaped bulb having the same radius as the collection bottle. At the outer edge of the ellipsoid, sediment particles are shed by gravity outside the collection bottle, while the water continues to adhere to the surface of the ellipsoid and run to the center collection point below the bulb. When the collection bottle is full the bulb seals the opening preventing evaporation and contamination.

5.10 Rain Gauge

ADEQ utilizes tipping bucket rain gauges equipped with a data logger. The buckets tip in response to every 1/100 inch of precipitation, which is recorded as an event on the event data logger. Gauge data will be used to correlate the timing of flow events in the upper watershed.

5.11 Laboratory Information

Accutest Laboratories will perform all chemical analysis. The laboratory will be responsible for laboratory QA/QC. As stated in Section 4.2 there will be four storm and two low flow sampling events targeted. Each sample costs approximately \$430 for the ambient parameter suite. The OAW sites (3) will be sampled under two baseflow events.

Accutest Laboratories
1741 W University Drive
Tempe, AZ 85281
Tel: (480) 275-8931

Table 4. Laboratory Costs

| Parameter | Events | Samples | Cost/each | Total |
|---------------------|--------|---------|-----------|-------------------|
| Baseflow | 2 | 6 | \$430.00 | \$2580.00 |
| Stormflow | 4 | 60 | \$430.00 | \$25800.00 |
| | | | | |
| <i>Grand Totals</i> | 6 | 66 | | <i>\$28320.00</i> |

REFERENCES

ADEQ, 2012, Jones, J., ed. Standard Operating Procedures for Surface Water Quality Sampling. Arizona Department of Environmental Quality TM06-02. Phoenix, AZ.

Helsel, D.R. and Hirsh, R.M., 2002. *Statistical Methods in Water Resources*. In Techniques of Water-Resources Investigations of the United States Geological Survey, Book 4, Chapter A3, Hydrologic Analysis and Interpretation. Washington D.C., 503p.

Appendix A Analytes

| Chemical | Analysis Type | Method | MR L | MRL Unit | Bottle | Holding Time |
|---|---------------|--------------------------|------|----------|------------------|--------------|
| ANTIMONY | DISSOLVED | EPA 200.8 | 3 | UG/L | Dissolved Metals | 6 MONTHS |
| ARSENIC, INORGANIC | DISSOLVED | EPA 200.8 | 3 | UG/L | Dissolved Metals | 6 MONTHS |
| CADMIUM | DISSOLVED | EPA 200.8 | 1 | UG/L | Dissolved Metals | 6 MONTHS |
| COPPER | DISSOLVED | EPA 200.7 | 10 | UG/L | Dissolved Metals | 6 MONTHS |
| LEAD AND COMPOUNDS (INORGANIC) | DISSOLVED | EPA 200.8 | 1 | UG/L | Dissolved Metals | NONE |
| MERCURY, ELEMENTAL | DISSOLVED | EPA 245.1 | 0.2 | UG/L | Dissolved Metals | 90 DAYS |
| ZINC | DISSOLVED | EPA 200.7 | 0.05 | MG/L | Dissolved Metals | 6 MONTHS |
| ALKALINITY, PHENOLPHTHALEIN | TOTAL | SM 2320B | 6 | MG/L | Inorganics | 14 DAYS |
| CALCIUM | TOTAL | EPA 200.7 | 5 | MG/L | Inorganics | NONE |
| CALCIUM CARBONATE | TOTAL | SM 2320B | 6 | MG/L | Inorganics | 14 DAYS |
| CARBONATE | TOTAL | SM 2320B | 6 | MG/L | Inorganics | 14 DAYS |
| CHLORIDE | TOTAL | EPA 300.0 | 2 | MG/L | Inorganics | NONE |
| FLUORIDE | TOTAL | EPA 300.0 | 0.4 | MG/L | Inorganics | 28 DAYS |
| HARDNESS (CaCO ₃ + MgCO ₃) | CALCULATE D | SM 2340B | 13 | MG/L | Inorganics | 6 MONTHS |
| HYDROGEN CARBONATE | TOTAL | SM 2320B | 6 | MG/L | Inorganics | 14 DAYS |
| PH | TOTAL | SM 4500-H+ | 1.68 | SU | Inorganics | 15 MINUTES |
| POTASSIUM | TOTAL | EPA 200.8 | 2 | MG/L | Inorganics | NONE |
| SODIUM | TOTAL | EPA 200.8 | 2 | MG/L | Inorganics | NONE |
| SPECIFIC CONDUCTIVITY | STANDARD | SM 2510B | 2 | UMHOS/CM | Inorganics | FIELD |
| SULFATE | TOTAL | EPA 300.0 | 2 | MG/L | Inorganics | 28 DAYS |
| TOTAL DISSOLVED SOLIDS | DISSOLVED | SM 2540C | 20 | MG/L | Inorganics | 7 DAYS |
| AMMONIA AS NITROGEN | TOTAL | SM 4500NH ₃ D | 1 | MG/L | Nutrients | 28 DAYS |
| KJELDAHL NITROGEN | TOTAL | SM 4500-NORG,C | 1 | MG/L | Nutrients | 28 DAYS |
| NITRATE + NITRITE | TOTAL | EPA 353.2 | 0.1 | MG/L | Nutrients | 28 DAYS |
| PHOSPHORUS | TOTAL | SM 4500-P BE | 0.1 | MG/L | Nutrients | 28 DAYS |
| SUSPENDED SEDIMENT CONCENTRATION | SUSPENDED | ASTM D3977C | 1 | MG/L | SSC | NONE |
| ANTIMONY | TOTAL | EPA 200.8 | 3 | UG/L | Total Metals | 6 MONTHS |
| ARSENIC, INORGANIC | TOTAL | EPA 200.8 | 3 | UG/L | Total Metals | 6 MONTHS |
| BERYLLIUM AND COMPOUNDS | TOTAL | EPA 200.8 | 1 | UG/L | Total Metals | 6 MONTHS |
| BORON (BORON AND BORATES ONLY) | TOTAL | EPA 200.7 | 0.2 | MG/L | Total Metals | 6 MONTHS |
| CADMIUM | TOTAL | EPA 200.8 | 1 | UG/L | Total Metals | 6 MONTHS |
| CHROMIUM | TOTAL | EPA 200.7 | 10 | UG/L | Total Metals | 6 MONTHS |
| COPPER | TOTAL | EPA 200.7 | 10 | UG/L | Total Metals | 6 MONTHS |

| Chemical | Analysis Type | Method | MR L | MRL Unit | Bottle | Holding Time |
|--------------------------------|---------------|-----------|------|----------|--------------|--------------|
| LEAD AND COMPOUNDS (INORGANIC) | TOTAL | EPA 200.8 | 1 | UG/L | Total Metals | 6 MONTHS |
| MAGNESIUM | TOTAL | EPA 200.7 | 5 | MG/L | Total Metals | NONE |
| MANGANESE | TOTAL | EPA 200.8 | 10 | UG/L | Total Metals | 6 MONTHS |
| MERCURY, ELEMENTAL | TOTAL | EPA 245.1 | 0.2 | UG/L | Total Metals | 6 MONTHS |
| SELENIUM AND COMPOUNDS | TOTAL | EPA 200.7 | 1 | UG/L | Total Metals | 6 MONTHS |
| ZINC | TOTAL | EPA 200.7 | 50 | UG/L | Total Metals | 6 MONTHS |

APPENDIX B
Health and Safety Plan

Davidson Canyon Health and Safety Plan

Location: Southeast of Tucson, Arizona

Objective: Perform field activities related to the deployment and maintenance of field equipment and to collect water samples from Davidson Canyon and Cienega Creek.

PPE Level: Level D

Chemical Protective Gloves

Rubber Hip or Chest Waders

Required Safety Training for Field Personnel:

40-hr OSHA 1910.12

Current 8-hr OSHA 19910.12

MSHA Part 48 Refresher

Known and Potential Hazards:

| Hazard | PPE | Precautions |
|---|---|---|
| Flash Flood | N/A | Use extreme caution when crossing flooded river fords in vehicles. Beware of changing weather conditions and be prepared to seek higher ground. Observe rules of thumb; don't wade in stream over factor of 9 (i.e., depth ft x velocity ft/s > 9). |
| Illegal Activity (Undocumented aliens/Drug Smuggling) | N/A | Be aware of surroundings. Avoidance of migrants is the best course of action in most situations. Leave any situation or location that elicits uncertainty or fear. Report concerns and observations to law enforcement. Cooperate fully with law enforcement and Border Patrol. |
| Lightning | N/A | Take cover in vehicle or building. |
| Contact with Chemicals and Poor Quality Water | Nitrile Gloves, Safety Glasses, Hip/Chest Waders | Avoid direct contact with polluted stream water. Wash-up thoroughly before eating, drinking, etc. Some sample bottles contain sulfuric or nitric acid, use caution when handling. |
| Heat Stress | N/A | Drink plenty of potable water; wear a hat and light colored clothing. Take breaks as needed. |

| | | |
|--|--|--|
| Hypothermia | Rain/Snow gear | Expect sub-freezing and wet conditions during winter months. Keep dry. |
| Desert wildlife- snakes, Africanized bees, and scorpions should be expected. | Snake leggings | Use caution walking to sites, and when reaching into equipment vaults. Avoid dark color clothing and eating bananas (attracts bees). |
| Slips, Trips, and Falls | Deep lugged boots, safety ropes, and flash lights at night | Use good footings, and ropes for assistance down steep slopes. |

Nearest Hospital: Concentra Medical Center, 4600 S Park Ave #5 ; see attached map

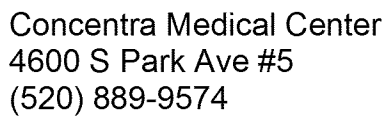
Equipment and Personal Decontamination:

Wash with non-phosphate (Liquinox) detergent and rinse with deionized water for instruments. Wash with non-phosphate (Liquinox) detergent, rinse with deionized water, rinse with nitric acid (5%), and a final rinse with D.I. water for automatic samplers, churn splitters and other equipment that will come into contact with the sample.

Antibacterial soap and water rinse will be used for personal hygiene and protection from any bacterial agents.

Emergency Contacts

| | |
|---|----------------|
| Police/Fire/Ambulance | 911 |
| Concentra Medical Center 4600 S Park Ave #5 Tucson, AZ 85714 | (520) 889-9574 |
| Pima County Sheriff San Xavier District Tucson, AZ 85713 | (520)351-3888 |
| US Border Patrol Sonoita Station 3225 Highway 82 Sonoita, AZ 85637 | (520) 444-5051 |



APPENDIX C
Field Emergency Contact Form

FIELD EMERGENCY CONTACT FORM
Davidson Canyon

| Employees to be in the field | Phone Number | Emergency Contact | Contact Phone |
|------------------------------|---------------|-------------------|---------------|
| John Doe | (602)123-4567 | (contact name) | (602)123-4567 |
| Jane Smith | (520)123-4567 | (contact name) | (602)123-4567 |

Vehicle License/Description:

| Contact Person | Work Phone # | Home Phone # |
|----------------|--------------|--------------|
| Jason Sutter | 602-771-4468 | 602-361-3720 |

Emergency Numbers

Pima County Sheriff
San Xavier District
Tucson, AZ 85713
(520) 351-3888

Arizona Department of Public Service
Tucson- District 8
6401 S Tucson Blvd
Tucson, AZ 85706
(520) 746-4500

US Border Patrol
Sonoita Station
3225 Highway 82
Sonoita, AZ 85637
(520) 444-5051

ADEQ Main Phone
800-234-5677

Vehicle emergencies contact 1-800-352-8400 until 10:00 p.m.
Check-in with contact person unless otherwise specified.

ITINERARY

| | | |
|---------------------|----------------|----------|
| Date: Mon, M/DD/YY | Check-in time: | Lodging: |
| Activities: | | |
| Date: Tues, M/DD/YY | Check-in time: | Lodging: |
| Activities: | | |
| Date: Wed, M/DD/YY | Check-in time: | Lodging: |
| Activities: | | |

APPENDIX D
Field Form



ADEQ Number _____

TMDL FIELD FORM **INSERT PROJECT NAME**

Site Code _____ Date _____ Water Sample Time _____

Site Name _____ Field Crew _____

| FIELD DATA | | | | | | | |
|-------------|--|------|-------------|-------------------------|---------------|---------------------|--|
| Air Temp. | | °C | Sp Cond. | | μS/cm | Weather Conditions: | |
| Water Temp. | | °C | ORP | | mVolt | | |
| D.O. | | mg/L | Turbidity | Avg= NTU | Bottle 1= NTU | DI Bottle 1= NTU | |
| D.O. % | | % | Standard | | Bottle 2= NTU | DI Bottle 2= NTU | |
| pH | | SU | Calibration | Cal = NTU Read = NTU | Bottle 3= NTU | DI Bottle 3= NTU | |

| FIELD CALIBRATIONS | | |
|---|--------------------------------|-----------------------|
| SEE LOG MULTIPROBE LOG BOOK _____ FOR CALIBRATION INFORMATION | | |
| % D.O. | Barometric Pressure in mm Hg = | Post-cal. Reading = % |

| SAMPLE COLLECTION INFORMATION | | |
|-------------------------------|---|---|
| <input type="checkbox"/> Grab | <input type="checkbox"/> Submerged Bottle (s) | <input type="checkbox"/> Reach pole <input type="checkbox"/> Churn Splitter |
| Circle where sample taken | LEW ---- ¼ ---- ½ ---- ¾ ---- REW | Run <input type="checkbox"/> , Riffle, <input type="checkbox"/> , Pool <input type="checkbox"/> |

| E. COLI | | | | |
|-----------------------------|--|--------------------------------|--|----------------------|
| Collection Time | | Incubation Time-in | | Enumeration Time |
| Number Positive Large Wells | | Number of Positive Small Wells | | Most Probable Number |

| EQUIPMENT USED, LOT NUMBERS, SAMPLES COLLECTED, GENERAL CONDITIONS | | | | |
|--|----------------|---------------------------------------|--|--|
| Parameter | Serial or Lot# | Samples Collected | Condition sampled | Pictures |
| Multiprobe | | Inorganics <input type="checkbox"/> | Baseflow <input type="checkbox"/> | Upstream <input type="checkbox"/> |
| Turbidity meter | | Metals <input type="checkbox"/> | Storm flow <input type="checkbox"/> | Downstream <input type="checkbox"/> |
| Flow meter | | Nutrients <input type="checkbox"/> | Spring Runoff <input type="checkbox"/> | Left Bank <input type="checkbox"/> |
| Sulfuric Acid | | SSC <input type="checkbox"/> | | Right Bank <input type="checkbox"/> |
| Nitric Acid | | Bacteria <input type="checkbox"/> | | Other (specify) <input type="checkbox"/> |
| Other | | Clean Metals <input type="checkbox"/> | | |

Form Checked by

Page 1 of 2



| FLOW MEASUREMENTS | | | | TOTAL Q= | CFS |
|--|---------------|------------|-----------------|----------|-----|
| Measurement from Run <input type="checkbox"/> , Riffle, <input type="checkbox"/> , Pool <input type="checkbox"/> | | | | | |
| Station | Distance (ft) | Depth (ft) | Velocity (ft/s) | Comments | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
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| 22 | | | | | |
| 23 | | | | | |
| 24 | | | | | |
| 25 | | | | | |
| 26 | | | | | |

IF UNSAFE TO GAGE USE FLOAT METHOD- NEED TO EST. CHANNEL WIDTH, STREAM DEPTH, AND VELOCITY (MEASURE TIME REQUIRED FOR AN OBJECT TO TRAVEL A GIVEN DISTANCE (I.E. 100FT) ONCE PLACED IN STREAM, REPEAT 5 TIMES TO DETERMINE AVERAGE VELOCITY)

FIELD NOTES

NOTE ANY DEVIATIONS FROM SOPs, CHANGE IN SAMPLE LOCATION, AND ANY OTHER USEFUL INFORMATION REGARDING DATA COLLECTED AT THIS SITE.

QUALITY CONTROL SAMPLE INFORMATION

| Type of QC Sample (ig blank, dup, etc) | Your Identifying Code | Lab Tracking Number |
|--|-----------------------|---------------------|
| | | |

Form Checked by